

STUDIES ON THE BIOLOGY OF INDONESIAN SCOLYTOIDEA

7. DATA ON THE HABITS OF PLATYPODIDAE*)

BY

L. G. E. KALSHOVEN

Blaricum, the Netherlands

INTRODUCTION

Material collected. Scope of the work

The opportunities for collecting *Platypodidae* or breeding them from infested timber have been the same in several respects as those for the study of the *Scolytidae*, and more particularly so for the ambrosia beetles among the latter (KALSHOVEN, 1958b, 1959). The main difference is that Platypodids live exclusively in trunks and limbs of some size and never in small branches and twigs. Trunks of trees in the pole stage and branches are suitable for breeding if they have a diameter of not less than 6—10 cm, and these small-sized hosts are inhabited by few very common species only. Most Platypodidae, all of them ambrosia beetles, require large trunks and logs for their development, and they bore right into the wood and penetrate to a considerable depth, extending their galleries even into the heart-wood of durable timber species. Therefore the opportunity for studying the pattern of their galleries and the composition of the broods is much more limited in the Platypodids than in the Scolytid ambrosia beetles. There must be facilities for handling large logs and billets, and for having them cut and sawn into suitable pieces. As the study of the shot-hole and pin-hole borers has been only a temporary item of some importance on the official programme during my work as a forest entomologist, such facilities have presented themselves rarely, and have mainly taken place at the Forest Research Institute in Bogor in 1924 and 1925. For a great part my notes are based on incidental observations and not on systematic investigations.

Identifications

The difficulties encountered in the early attempts to have the collected specimens identified have been very similar to those experienced with the identification of the *Scolytidae* (KALSHOVEN, 1958b), although less complicated.

The first consignments of samples, including material of some 35 different

*) Nrs. 1, 2 and 3 of this series appeared in *Entom. Berichten*, vol. 18, 1958, n. 4, first and second part, in *Tijds. v. Entom.*, vol. 101 and 102, 1958 and 1959, nos. 5 and 6 in *Entom. Berichten*, vol. 19, 1959 and vol. 20, 1960, respectively.

species, were submitted to Lt. Colonel F. WINN SAMPSON in London, in 1923—1925. Out of these a dozen species were identified with species known to this specialist at the time, and being of common occurrence and wide distribution in the Indomalayan region. The rest were preliminarily assigned to varieties of known species and to new species, but their description had not been published when SAMPSON died in 1927.

In 1933 a large consignment was prepared, which contained samples or single specimens of about 60 species, and included material collected by F. C. DRESCHER, as well as duplicates of several samples sent to SAMPSON previously. This consignment was submitted to Dr. C. F. C. BEESON, Dehra Dun, India, who had also sent to him directly from London a part of my Platypodids which had not been finished by SAMPSON. I did not hear about this sending any more, nor did I receive specimens in return. However, BEESON's paper of 1937, dealing with the genus *Crossotarsus*, contains the descriptions of five new species and one new subspecies besides a reference to a known species, all based on our material.

An extensive consignment, comprising samples of all Platypodid species still available was submitted to Professor K. E. SCHEDL in 1938, who in 1941 (1941b) published descriptions of 12 new species of *Platypus* and *Diapus* from this material and listed the localities and numbers found on the labels of the specimens belonging to 17 known species. SCHEDL (1941a) described in a paper on variation of the *Platypi cupulati* another three species, partly from Java and Sumatra, and mentioned other species.

Looking through the boxes of the old SAMPSON collection in the British Museum in London in 1953, I happened to find again some of my early material, including single cotypes of ten species considered new to science and named by him at the time, without the description having been published afterwards. These specimens were sent to Professor SCHEDL who in 1954 described three new species and the female of a fourth species out of them. Very recently the remaining part of the ten species were identified with species already described in earlier papers.

Notes on the hosts

The hosts of the Platypodid borers have been recorded in the same way as in the Scolytids and their identity has been stated on the same evidence (see KALSHOVEN, 1958b, Introduction).

A preference of the borers for certain timbers of botanical affinities appears to occur rather seldom, but the differences in their degree of selectivity — or rather, unselectivity — has not been evaluated in my notes, as it was done in an interesting recent paper by BROWNE (1958).

All Platypodids appear actually to be secondary borers, only able to thrive in parts of weakened, sickly and dying trees. Still it has been observed in several instances that the beetles may alight on and try to bore into the trunks of healthy trees. A resumé of these cases has been given in a chapter following the special part, which deals with the notes on the different species.

The gallery system

In order to avoid reiterations in the notes, some general remarks concerning the gallery patterns characteristic of the Platypodids may precede here. There is distinctly less variation in these patterns than there is in the Scolytid ambrosia beetles. Two main types can easily be distinguished, viz., those apparently common to most species of *Platypus* and *Diapus*, and those to be found in *Crossotarsus* c.s.

In *Platypus* the entrance and main tunnels are excavated across grain in their full length, therefore situated in wide, more or less horizontal planes, and showing little or moderate ramification. The pupal cells are placed vertically in short rows at the upper and the opposite lower side in some parts of the tunnels. Their comb-like arrangement is somewhat similar to that in *Xyloterus* and *Scolyto-platypus*. Short lateral branches furcating at the terminal parts of the galleries appear to be laid out for the purpose (Pl. 1, fig. 1—4).

It is rather difficult to expose lengthy tunnels completely, and one has to try to carve them out on cross sections through the wood.

The *Crossotarsus* species also start their tunneling by the excavation of a main gallery entering the wood across grain, first radially and straight, later more or less sinuously or curving parallel to the circumference. These tunnels remain comparatively short and soon vertical branches are bored at some distance from each other, beginning some one to three cm from the entrance and leading perpendicularly upwards and downwards. The vertical galleries are gradually lengthened and they are split up into 2—4 branches, each terminating eventually in one to three pupal cells. The first and middle vertical branches, as a rule, become the most elaborate. Nearly all the pupal cells are excavated in the same direction as the supporting stalk-like part of the tunnel, but a few in a reverse direction (upside down). The complete vertical portions with the cells have, when exposed, the aspect of miniature, sparsely furcated cactus trees, or, when there are many pupal cells, they resemble small irregular candelabra. The walls of the tunnels are stained black with the exception of an entrance part of 1.5—2.5 cm, and the freshly formed terminal parts, and cells (Pls. 1 and 2).

The whole tunnel system is situated in a vertical plane, though not a flat one but more or less curving and sinuating according to the course of the main gallery. Therefore it is possible to expose the pattern fairly completely by sawing the infested section in disks containing the gallery in the middle part and by trying to follow the vertical plane in splitting the wood. The pupal cells, however, are often so numerous and crowded into small spaces that they are formed parallel to each other on both sides of the vertical plane and cannot be shown all from the lateral side. The extension of these groups of cells can be observed more satisfactorily on an additional cross section (Pl. 2, fig. 2b).

More particulars about the gallery system of oriental *Platypodidae*, illustrated by photographs and drawings can be found in BEESON's handbook (1941).

Acknowledgments

It will be clear from the introductory notes that I am most indebted to Professor K. E. SCHEDL for the final identification of my specimens and the

description of the new species. The exchange of specimens and the discussion of viewpoints with Mr. F. G. BROWNE has been very profitable in recent years, and I have followed his suggestion for the grouping and sequence of the species in this paper.

During this part of the work on my material and notes of the Scolytoids I have been favoured by the same hospitality at the laboratories of the Amsterdam University as mentioned in my preceding paper (KALSHOVEN, 1959).

Most of all, my thanks are due to the Netherlands Organization for the Advancement of Pure Science (Z.W.O.), as the preparation of the paper has been made possible by a grant received from this Institution.

SPECIAL PART

PLATYPINAE

Platypus sulcati.

Platypus signatus Chap., 1865, ♀ and ♂ 7.5—8.5 mm. Java: boring in the trunk of a *Symplocos* tree, 35 cm in diameter, E. slope of Mount Salak near Tjidahu, 800 m, V.1922; in a rubber tree (*Hevea brasiliensis*) on Buaran Estate near Pekalongan, III.1923 (leg. SPECHT GRIJP); in log of *Sterculia urceolata*, received from Besuki, XI.1923; in logs of *Pometia tomentosa*, *Schima noronhae* and other timber species received from felling area on S. slope of Mount Gedé, 800—1200 m, XI-XII.1924; in billets of *Kickxia arborea* in lowland forest near Bandjar, I.1933.

The *Symplocos* was standing in virgin forest on the border of a felling area and was still bearing much foliage in the crown. The base showed some axewounds and was attacked by the borer up to at least 4 m. The larvae were very active in the galleries which had been bored to a depth of 10 cm and more, some sap and bubbles were oozing from the holes where the parent beetles were busy.

The rubber tree in Pekalongan had been split over its total length by lightning, but was still living. The beetles were boring right through the bark notwithstanding the latex-flow (observation by SPECHT GRIJP; cf. KALSHOVEN, 1924, p. 358).

P. webberi Schedl, 1939, ♂ 6.8—6.9 mm (the ♀ has remained unknown so far). W. Sumatra: a few specimens in branches cut from nutmeg trees (*Myristica fragrans*) which suffered from "premature death" disease (KALSHOVEN, 1954) in groves at Manindjau near Padang, XI.1930 and III.1931.

P. westwoodi Chap., 1865, ♀ and ♂ 6.0—6.5 mm. Java: in lightning-struck rubber tree on the same occasion as *P. signatus* was found, Pekalongan, III.1923 (leg. SPECHT GRIJP; cf. KALSHOVEN, 1924, p. 358 under "*P. lucasi* Chap. var. and *P. westwoodi* Chap.").

P. jansoni Chap., 1865, ♀ 5.2—5.5 mm, ♂ 4.8—5.2 mm. Java: in dying *Parkia speciosa*, Madjalengka, X.1913 (leg. DE WIJS), and Pekalongan, III.1937; in log of *Sterculia* sp. received at the Forest Research Station in Bogor, 1918; the same for a log of *Artocarpus elastica* originating from Tegal, IV.1919 (leg. W. C. VAN HEURN), a log of "plunting" from N. Kediri, V.1919, a balk of

Sterculia foetida from Tegal, VII.1919, and a balk of *Millettia debiscens* from N. Kediri, VIII.1919; in dying *Aleurites moluccana*, Paree, Kediri, II.1920; in dying *Sterculia campanulata*, same dates; in trunk of *Cocos nucifera* palm, apparently struck by lightning at Tjikaso, near Sukabumi, XI.1922 (leg. LEEFMANS) and Djombang, VII.1940 (leg. R. AWIBOWO); one of the species in borer-infested *Albizia* timber received at the Tea Experiment Station, Bogor, I.1923 (leg. Ch. BERNARD); found boring in the trunk of diseased rubber trees (*Hevea brasiliensis*) at different places and dates, as reported by the Experiment Stations in West and East Java, 1924, 1926, 1937 (cf. KALSHOVEN, 1924, p. 358); in *Dalbergia latifolia*, Banyumas, II.1926; taken at lamp-light, Tjisarua near Bogor, 900 m, IX.1926; in *Mangifera indica* struck by lightning, Buaran Estate near Pekalongan, IV.1928 (leg. SPECHT GRIJP); in billets cut from newly dead *Tectona grandis*, Pemalang, IV.1928; in dead tjaringin (*Ficus ? benjamina*), Tapos, Mount Gedé, 900 m, I.1933; in *Tectona* struck by lightning, Bandjar, IV.1933; found boring in the trunk of *Sterculia campanulata* and penetrated into the very centre of the wood, Purwakarta, VIII.1935 (leg. VAN OMMEN).

In the *Aleurites* tree (1920) there were many bore holes in vertical rows in slits in the bark on the trunk, and several beetles were drowned by the resin flow.

P. vethi Strohm., 1912 (syn.: *P. suffodiens* var. *malayensis* Schedl, 1936, renamed *P. spretus* Schedl, 1939), ♀ 5.55—6.05 mm, ♂ 4.95—5.6 mm. J a v a : in trunk of old *Cinnamomum camphora* tree felled in the Botanical Gardens Tjibodas, 1450 m, VIII.1923; in large billet of *Podocarpus imbricata*, used in an exhibition in Bandung, VI.1924; in *Dalbergia latifolia*, Banyumas, 400 m, III.1926; in *Schima noronhai*, at Artjamanik, N. of Bandung, 1200 m, VI.1927; in broken top of *Sarcocephalus cordatus*, lying on the ground in the lowland forest near Bandjar, VII.1932.

The *Dalbergia* tree was sound, growing along the road side. Only a single specimen of *vethi* was found in it, in company with several specimens of *P. solidus* and all had been killed by the flow of "kino"-sap. The *Schima* tree was also alive but was attacked in its base by the primary longicorn borer *Trachylophus approximator* (cf. KALSHOVEN, 1933). BROWNE (1958) has mentioned the species as a typical and important component of the characteristic borer-fauna in heavily tapped *Dyera costulata* in Malaya.

P. suffodiens Samps., 1913, ♀ 4.6—4.7 mm, ♂ 4.3—4.45 mm. W. J a v a : in a *Nauclea* tree in the forest near the Tjibodas Gardens, Mount Gedé, 1450 m, IX.1923. S u m a t r a : one gallery in a billet of "sendik" wood sent by a timber merchant operating in Buangara near Singkel, V.1924.

In the *Nauclea* tree in which the borer was causing a heavy infestation of the massive base, the cambium had already turned black over a large part of the circumference and little foliage had been left in the crown; the base was covered with frass.

Gallery system. The tunnel in the "sendik" wood sample enters the wood radially for a few mm only, and then bends in a very oblique direction sub-parallel to the circumference, reaching a depth of 3.5 cm after running over a length of 12.5 cm. Only one male beetle was extracted from the tunnel, the terminal part of which is missing.

P. bajulus Schedl, 1936. Size of the Java specimens: ♀ 3.8—3.95 mm, ♂ 3.6—3.8 mm (SCHEDL gives for the types from Mentawai Island 5.0 mm for the ♀ and 4.5 mm for the ♂, mentioning that the specimens from Sumatra are even somewhat larger). W. J a v a : in broken top of large *Sarcocephalus* tree lying on the ground and in heavily borer-infested log of *Evodia* sp., lowland forest near Bandjar, VII.1932; in dead trunk of *Horsfieldia*? *glabra* and in billets of *Artocarpus elastica* kept in the forest, Bandjar, II.1933; in log of *Podocarpus imbricata* in a timber yard at Bandung, VIII.1940 (leg. P. A. BLIJRDORP).

P. hybridus Schedl, 1935, ♂ 6 mm. B a l i : boring in a log of *Diospyros pseudo-ebenum*, received from Tjandikusumo, at the Forest Research Institute in Bogor, 1920.

The species appears to be associated with trees of the genus *Diospyros* — some of which produce the very hard, black ebony wood — as it has also been reported from *Diospyros* spp. in the Philippines (SCHEDL, 1938, p. 423) and from Malaya (BROWNE, 1955, p. 371).

P. caryophyllatus Schedl, 1941, ♀ ♂ 4.2—4.5 mm. M o l u c c a s : found boring in the trunk of a clove tree (*Eugenia aromatica*) near Ambon, III.1936 (leg. DER KINDEREN).

Platypi hirtelli.

P. curtus Chap., 1865, ♀ 3.75 mm (not yet described), ♂ 3.4—3.5 mm. S u m a t r a : in billets of *Dipterocarpus* sp. and *Dryobalanops camphora*, sent by a timber merchant from Buangara near Singkel, V.1924; extracted from a log of *Durio carinatus* submitted from Indragiri by the Forest Service, VII.1934.

In Malaya this is a very common ambrosia beetle, attacking timber of any size from 8 cm up, according to BROWNE (1935) who listed 7 hosts, most of them Dipterocarpaceae.

Platypi adjuncti.

P. edentatus (Bees., 1937), 4.0 mm. W. J a v a : a single male specimen found boring in the base of a *Schima noronhae* tree, infested by the longicorn borer *Trachylophus approximator*, at Artjamanik, N. of Bandung, 1200 m, VI.1927.

Platypi quadrifissi.

P. insulindicus, Schedl (new name introduced by its author in 1952 for *P. bicornis* Schedl, 1939), ♂ 2.8—3.1 mm. W. and C. J a v a : a single specimen in timber of *Durio zibethinus*, Bogor, VI.1919; a few galleries in borer-infested main branches, 15 cm in diameter of a newly dead *Kopsia flavida*, in the Botanical Bardens, Bogor, II.1924; some 6 specimens in branches of dying *Parkia speciosa*, Pekalongan, VIII.1937 (leg. H. R. A. MULLER). B o r n e o : a single specimen in a sample of *Alstonia* timber received from the Forestry Service. I.1933.

BROWNE (1938, p. 29) has published a few details on the construction of the tunnels of this beetle.

Platypi cupulati.

P. cupulatus Chap., 1865, ♂ and ♀ 4.5—5.0 mm. Sumatra: one male specimen in its gallery in a small sample of borer-infested shingles, made of *Eusideroxylon zwageri* timber, district Banyuasin/Kubu, V.1924 (submitted by the Forest Service); a few initial galleries, no brood being present, in *Terminalia catappa*, received from a timber merchant in Singkel, Atjeh, VI.1924; a few specimens found dead in their burrows in the spear of living *Agave sisalana* plants in Deli, VIII.1926 (mentioned in LEEFMANS, 1927, p. 6). Borneo: in *Alstonia* sp. in company with *P. cavus* and *P. pseudocupulatus sundaensis*, submitted by the Forest Service, I.1933.

In Malaya the species has frequently been observed boring in injured and diseased rubber (*Hevea*) trees and stumps (CORBET/GATER, 1926), and, since, BROWNE has stated (1938, 1949), that this borer is one of the most abundant ambrosia beetles in Malaya. BEESON (1941) has listed 19 timber species — all different from those just mentioned — which have been found attacked by the borer in India, Indochina and Malaya.

It is remarkable, indeed (cf. SCHEDL, 1941a), that *cupulatus* has not been found in Java. The mentioning of the species by LEA (1909) as having been taken alive at Melbourne in wood from Java, must have been based on an inaccurate report on the origin of the timber (perhaps a place in Java has been used as a transit harbour), or on a misidentification.

P. cavus Strohm., 1913, ♀ and ♂ 3.75—4.5 mm. Most samples mentioned hereafter were identified by SAMPSON in 1924 as *P. caliculus* Chap., 1865, originally described from Siam and since recorded from the Philippines, Burma and the Seychelles (SCHEDL, 1941), but SCHEDL has preferred to assign them to STROHMEYER's species, which was described from specimens, 5.1 mm in size, from India (see also BEESON, 1941). W. Java: in dead "kikopi" tree (fam. Rubiaceae) in secondary forest near Tjiwidei, 1000 m, XII.1918; numerous in trunk of *Vernonia arborea*, killed by white grubs at the roots, in forest plantation on Mount Salak, 700 m, VIII.1919; a single specimen ex *Albizia* timber, submitted by the Tea Experiment Station, I.1923; numerous in billets of *Dysoxylum* sp., *Nyssa javanica*, *Pometia pinnata*, *Schima noronhae* and "huru mangga" (? fam. Lauraceae), received from felling area on S. slope of Mount Gedé, 800—1000 m, XI-XII.1924; in newly felled *Schima noronhae* and in fire-killed young trees, as well as in sound specimens of the same tree species, 10 cm in diameter, standing on exposed ridge at Artjamanik, N. of Bandung, 1200 m, VI.1927; a few specimens boring in rubber tree, *Hevea*, Pasirwaringin Estate, Bantam, V.1928, submitted by the Tea Experiment Station; a few specimens taken at light, and a single specimen in dead *Nauclea excelsa*, Bandjar, VII.1932; a single specimen in a borer-infested dead "tjaringin" (*Ficus ?benjamina*), Mount Gedé, Tapos, 750 m, I.1933; in trunk of *Tectona* tree struck by lightning, Bandjar, IV.1933; in log of *Podocarpus imbricata* in timber yard at Bandung, VIII.1940 (leg. P. A. BLIJDRP). E. Java: from "bleeding" *Dalbergia latifolia* trees caused by primary attack by wetwood borers, Madiun, III.1924 (leg. ALTONA) and at Klangon on Mount Pandan, 300 m, V.1924; one ♀ in dead *Swietenia macrophylla*, Paree, III.1925; two specimens found boring through the

bark of rubber trees (*Hevea*) on Kedaton Estate, submitted by Experiment Station Djember, VIII.1937. Bali: a few specimens in log of *Diospyros pseudo-ebenum* received from Tjandikusuma, at the Forest Research Institute, Bogor, VII.1920. Sumatra: in billet of *Terminalia catappa*, 35 cm in diameter, received from timber merchant operating near Singkel, V.1924; a single specimen found boring in timber of *Pinus merkusii* at Takengon in Atjeh, ca 1000 m, 1924 (submitted by the Forest Service).

Gallery system. Two tunnels in the *Dysoxylum* wood have been preserved which were carved out at the time (1924) and have a length of 47.5 and 76.5 cm. with some parts still missing. They are broadly furcated with a small subtriangular widening at the junctions. The lateral branches with the pupal cells are situated at a depth of 10—20 cm. The combs have 4—7 cradles at each side, placed at 1—2 mm distance from each other over a length of 1—1.5 cm. (Pl. 1, fig. 1). One terminal furcation shows 27 pupal cells.

P. pseudocupulatus subsp. *sundaensis* Schedl, 1941, ♀ and ♂ 3.45—3.7 mm. Several of the samples mentioned hereafter were identified by SAMPSON in 1924 and by BEESON in 1928 as *P. lepidus* Chap., with which species in any case the beetle is very closely allied. Java: breeding in log of *Sterculia foetida* received in Bogor from the E. Tjirebon Forest District, VII.1919; a few specimens in log of *Millettia debiscens* from Kediri, VIII.1919; boring in *Aleurites moluccana*, damaged by mud stream, Paree, Kediri, II.1920; taken at lamp light in resthouse Gadungan, Kediri, II.1920, I.1924 and in Kedungdjatti, V.1921; breeding in *Hevea* trees damaged by lightning and attacking dying as well as apparently sound *Erythrina* trees, Buaran Estate near Pekalongan, 200 m, II-IV.1923 (leg. SPECHT GRIJP); boring in the trunk of living *Hevea* trees and drowned in the resulting latex flow, Balong Estate, Japara, V.1923 (both latter cases mentioned under "*P. lepidus* or *caliculus*" in KALSHOVEN, 1924); a single specimen in *Hevea* at Krumpit Estate, Banyumas, III.1924 (leg. MENZEL); breeding in trunk of young *Dalbergia latifolia* attacked by root fungus, forest plantation Gadungan, Paree, I-V.1924; beetles drowned by flow of "kino" sap after attack on apparently sound *Dalbergia* trees on border of plantation at Klangon, Mount Pandan, V.1924, and along road side, Banyumas District, 400 m, III.1926; in dead *Ficus elastica*, teak forest in Semarang District, I.1925; a single specimen in light-trap hoisted into the crown of a teak tree, XI.1927, and another at the lamp, IX.1928, Field Station at Gedangan. S.E. Borneo: ex "pulanten" timber, *Alstonia* sp., submitted by forest officers, VI.1919 and I.1933. N. Sumatra: a few specimens found dead in their burrows in the spear of living *Agave sisalana* plants in Deli in company with *P. cupulatus*, VIII.1926 (mentioned under *P. lepidus* in LEEFMANS, 1927, p. 6).

P. cupulatus Schedl, 1941, ♀ and ♂ ca 2.8 mm. Sumatra: a few specimens found in timber of *Durio carinatus* in Indragiri, submitted by the Forest Service.

P. forficula Chap., 1865, ♀ and ♂ 3.4—3.8 mm. Java: in log of *Artocarpus elastica*, V.1919, and in log of *Sterculia foetida*, VII.1919, both received from the E. Tjirebon-Tegal range at the Forest Research Institute, Bogor; bred from sections of *Actinophora fragrans* trees, which had been killed by the zigzag borer, *Agrilus kalshoveni*, at Balapulang near Tegal, VII.1925 (leg. VERBEEK).

P. biuncus Bldf., 1896, ♀ and ♂ of the typical form 2.9—3.2 mm, and a variety which has the unci of the declivity more developed and set at a less obtuse angle to the cupula, 3.2—3.65 mm. Java: in logs of *Artocarpus elastica*, received from Tegal, *Semecarpus heterophylla*, *Gluta rengas* and *Millettia debiscens* from N. Kediri and *Bischofia javanica* from Djember, all kept in the timber yard of the Forest Research Institute in Bogor, V-XI.1919; (a) in trunk of young diseased rubber tree, *Hevea*, 15 cm in diameter, (b) three short galleries in the branches and frame of newly dead borer-infested *Thea sinensis*, 2—5 cm thick, (c) one gallery in dead *Castanospermum*, 20 cm in diameter, and (d) numerous specimens in felled *Cananga odorata*, all these in the Botanical and Experimental Gardens in Bogor, V-VI.1924; in billet of *Schima noronbae*, received from a felling area on S. slope of Mount Gedé at 900 m, XII.1924; in young trees of secondary forest killed by fire at Artjamanik, N.E. of Bandung, 1200 m, VI.1927; bred from sections of *Actinophora fragrans* killed by *Agrilus kalshoveni* in the forests near Tegal and Pemalang, IV-VII.1928 (leg. VERBEEK; cf. the data mentioned by SCHEDL, 1933, p. 176 which are completed and corrected here); a single ♀ from trunk of *Tectona* struck by lightning, Bandjar, IV.1933. Sumatra: in borer-infested sample of ironwood shingles, *Eusideroxylon zwageri*, received from Palembang, VI.1924.

BLANDFORD's record (1896) of the species having been collected from tobacco bales from Sumatra received in Paris has remained unexplained.

Gallery system and brood. The infestation of the dying trunks in Bogor, examined in 1924, was not so far advanced that pupal cells had been formed. Some galleries were laid open on cross sections. The main gallery, which is rather sinuate, remains unforked for a length of 7—14 cm. The initial galleries in *Thea*, 4—5 cm in length, did not contain any brood. However, two short galleries in *Cananga*, 3.5—4 cm long, the latter furcated at the tip, contained 8 eggs + 1 larva and 10 eggs + 9 larvae. A more elaborate system in *Hevea* shows primary and secondary furcation; it has a length of 13 cm and contained 10 larvae.

P. tenuissimus Schedl, 1941, ♀ and ♂ 3.3—3.4 mm. W. Java: in small numbers in billets of *Nyssa javanica* and *Castanea argentea*, received from felling area on S. slope of Mount Gedé, 900 m, XII.1924; in fire-killed young trees of *Eurya japonica* at Artjamanik, N.E. of Bandung, 1200 m, VI.1927.

Platypi oxyuri.

P. solidus Walk., 1859, a very common and non-selective species, which will be dealt with in a separate paper.

Platypi alternante-depressi.

P. fraterculus Schedl, 1941, ♀ 1.85—1.95 mm, ♂ 1.7—1.95 mm. W. Java: in trunk of old borer-infested *Cinnamomum camphora*, felled at the Tjibodas Gardens, Mount Gedé, 1500 m, IX.1923; in dead parts of *Marumia muscosa* (numerous specimens), of *Castanea argentea* (two specimens) and of *Endriandra rubescens* (a single specimen), Mount Gedé, Tapos, 750 m, II-X.1933.

Platypi lunati.

P. borni (Schedl, 1934) (♂) (syn. *Crossotarsus biceps* Bees., 1937 (♀ and ♂)), ♀ 4.05—5.35 mm, ♂ 4.0—4.25 mm. W. and C. J a v a : in *Cinchona ledgeriana*, the quinquina tree, Kertamana Estate, S. of Bandung, ca 1000 m, XII.1909, leg. ROEPKE (the types used by SCHEDL for the description of the ♂; the names of the host and the locality being rectified here); a few specimens boring in living *Acacia decurrens*, at Artjamanik, N.E. of Bandung, 1200 m, VI.1927; in *Horsfieldia ? glabra* at Baturraden, ca 800 m, XI.1932, leg. F. C. DRESCHER; in borer-infested parts of *Quercus* sp. at Tapos, Mount Gedé, 800 m, IX.1933 (the latter two records already mentioned by SCHEDL, 1941b); one specimen found mixed in a series of *Crossotarsus terminatus* from *Castanea argentea*, Tapos, VIII.1933.

Platypi angustati.

P. perinimicus Schedl, 1941, a small and very slender species, ♀ 2.45—2.75 mm long and 0.5—0.55 mm broad, ♂ 2.3—2.5 mm long and 0.45—0.50 mm broad. W. J a v a : in the wood of tea chests, Bogor, VII.1919 (leg. Ch. BERNARD); breeding in some numbers in the trunk of newly felled, old *Cinnamomum camphora*, in the Tjibodas Gardens on Mount Gedé, 1500 m, IX.1923; in logs of *Castanea javanica*, *C. argentea* and "huru mangga" (? fam. Lauraceae), received from a felling area on S. slope of Mount Gedé, at 800—1000 m, XI.1924; in young tree of *Eurya japonica* killed by fire in plantation at Artjamanik, N.E. of Bandung, 1200 m, VI.1927.

Gallery system. The investigation of samples of the infested huru mangga in 1924 led to the exposure of 7 thread-like tunnels. They enter radially in the wood for some 1.5—2.5 cm (once 5.5 cm) and then bend and run more or less parallel to the circumference. The largest gallery is 35 cm in length and is forked. A terminal portion has 11 pupal cells with different spaces between them (Pl. 1, fig. 4).

Platypi incertae sedis.

P. deflectus Schedl, 1941, ♀ 3.45—3.5 mm, ♂ 3.25—3.35 mm. W. J a v a : in billet of borer-infested *Castanea javanica*, 38 cm in diameter, received from felling area on S. slope of Mount Gedé, 900 m, XII.1924; in *Quercus* sp., Tapos, Mount Gedé, 800 m, IX.1933.

The gallery system is apparently broadly ramified in a horizontal plane. A two-sided comb-like arrangement of some 8 pupal cells was found in the *Castanea* wood (Pl. 1, fig. 3).

P. drescheri Schedl, 1941, ♂ 3.2—3.4 mm. W. J a v a : a few specimens in logs, 40—50 cm in diameter, of *Nyssa javanica*, "huru dusun" and "huru mangga" (both probably belonging to the fam. Lauraceae), received from a felling area on slope of Mount Gedé, 900 m, XII.1924.

P. saltatorinus Schedl, 1954, ♀ 3.4 mm. W. J a v a : 2 ♀ and 1 ♂ beetles from log of *Castanea javanica*, 30 cm in diameter, data as in the preceding species.

P. strigillatus Schedl, 1941, 1954, ♀ and ♂ 3.4 mm. W. Java: a few specimens from the same log of *Castanea javanica* as the preceding species.

Gallery system and brood. During the collection of the beetles in 1924 two complete tunnels were exposed on one cross-section. They are thread-like, broadly branching, and curiously enough, intersect each other twice, once in the initial part and again in a later section. The largest tunnel, 29 cm in length, has a lateral branch which intersects the main gallery; the other tunnel is 21 cm in length. Two parent couples and 15 larvae were extracted from the combined systems.

P. substriatus (Schedl, 1936), ♂ 3.5 mm (SCHEDL gives 4.1 mm for the size). W. Java: three specimens collected from old borer-infested log of *Cinnamomum camphora*, lying in the Tjibodas Gardens, Mount Gedé, 1500 m, IX.1923.

Platyscapus Schedl, 1941 (= *Platypi antennati* Chap., 1865).

P. artecostatus Schedl, 1941, ♀ 2.95—3.0 mm, ♂ 2.7—2.75 mm. Java: from unidentified log in timber yard at the Forest Research Institute, Bogor, 1919.

P. alternaticostatus Schedl, 1941, ♀ 3.3—3.45 mm, ♂ 3.05—3.15 mm. W. Java: bred from billet of *Dysoxylum* sp., 58 cm in diameter, received from felling area on S. slope of Mount Gedé, 900 m, XII.1924.

Gallery system and brood. In a tunnel in the *Dysoxylum* wood, running radially for 4.5 cm and continuing in a more sinuate way for another 4 cm, 7 eggs were found besides the parent couple.

P. volaticus (Schedl, 1936/1941) (originally described as *Platypus excedens* var. *volaticus*), ♀ 3.55—3.75 mm, ♂ 3.15—3.35 mm. W. Java: bred in numbers from the same log of *Dysoxylum* sp. as the preceding species, XII.1924.

Gallery system. One example came to hand during the investigation of the infested wood. It shows some furcation; the first side branch is formed 5 cm from the entrance, the next part of the gallery runs parallel to the circumference, another part is nearly straight; a terminal portion has 4 pupal cells in comb-like arrangement; the total length of the system is 33.5 cm.

Stenoplatypus Strohm., 1914.

S. sexfenestratus (Bees., 1937), ♀ 4.55—4.8 mm, ♂ 4.05—4.45 mm. W. Java: bred from billets, ca 40 cm in diameter, of *Castanea tunggurut* and *C. javanica*, received from felling area on S. slope of Mount Gedé, 900 m, XI.1924; the beetles appearing XII.1924—I.1925; in logs of *Castanea argentea* in timber yard at Bandung, VIII.1940 (leg. P. A. BLIJRDORP).

BEESON (1937) recorded the borer from *Castanopsis* sp. in Bengal. Therefore the species appears to be associated with the Fagaceae.

S. semiermis (Schedl, 1941), ♀ 3.05—3.1 mm, ♂ 2.7—2.85 mm. W. Java: a few specimens in dead *Quercus* sp., Tapos, Mount Gedé, 800 m, IX.1933.

In Malaya BROWNE has collected the species also from *Quercus* sp. (SCHEDL, 1942, p. 172). As in the preceding species there appears to be an association with the Fagaceae.

Carchesiopygus Schedl, 1939 (*Crossotarsi cancellati* Chap., 1865).

C. wollastoni var. *multidentatus* Strohm., 1913, ♀ 8.0 mm, ♂ 6.4—7.0 mm. Java: a single male specimen found in its gallery in log of unidentified timber, received from felling area on S. slope of Mount Gedé, 1000 m, XI.1924; one male in a mixed sample of borers in *Dalbergia latifolia* collected by a forest ranger at Wonohardjo, Banyumas, II.1926.

Crossotarsus Chap., 1865.

C. saundersi Chap., 1865 (according to F. G. BROWNE the species belongs to the subgenus *Trachyostus* Schedl, 1939), ♀ and ♂ 3.4—3.9 mm, a wide spread species even occurring in Africa. Java: a few specimens in log of *Gluta renghas*, several in log of *Millettia debiscens* received from N. Kediri, and in log of *Spondias lutea* in timber yard of the Forest Research Institute, Bogor, VIII-IX.1919; numerous in trunk and branches of dead *Theobroma cacao* trees in the Experimental Garden, Bogor, IV.1921 and XI.1924; infesting newly dead rubber trees (*Hevea*) on Kaliwringin Estate near Bodja, XII.1922, and Krumpit Estate in Banyumas, III.1924 (see KALSHOVEN, 1924); breeding in borer-infested trunk, 15 cm in diameter, of dying *Kopsia flavida*, Botanical Gardens, Bogor, II.1924; the same in newly transplanted young tree of *Canarium commune*, in parts 4.5—7 cm thick, Bogor, II-III.1924; single galleries in dead branches, 6—12 cm thick, of *Mangifera foetida*, *Pithecolobium lobatum* and *Durio zibethinus*, Bogor, IV-V.1924; three galleries (one with brood) in borer-infested dead trunk and branches, 6—15 cm thick, of unpruned *Thea sinensis* in the Experimental Garden, Bogor, VI.1924; breeding in the branchwood, 9—10 cm in diameter, of *Dalbergia latifolia* trees, killed by root fungus in plantation near Paree, Kediri and at Klangon, Mount Pandan, 300 m, V-VII. 1924; a few specimens in young, apparently diseased mahogany trees (*Swietenia*), Paree, XI.1924; 5 ♂ and 1 ♀ from borer-infested portion of a dead *Ficus* sp. (iprit), Gedangan, XII.1924; in dead branches, 6 cm thick, of *Albizia procera*, Gedangan, V.1925; a single ♂ in dead *Actinophora fragrans*, Gedangan, IV. 1930 (leg. VERBEEK); in billets, 6—12 cm thick, cut from fire-killed small trees of *Albizia lebbbeck*, I-III.1931 and *Dysoxylum* sp. and *Toona*, VII-IX.1931; breeding in numbers in 'dry' 'ingas' tree (*Gluta* or *Semecarpus* sp.) in the Margasari Forest Range near Tegal, VII.1932; a few specimens in *Pithecolobium* ("matjem djengkol"), Tapos, VI.1953 (the latter mentioned by SCHEDL, 1941b).

BROWNE (1935) mentioned 11 hosts, besides unidentified species, from Malaya, and in his table (1958) of relatively unselective Platypodids *C. saundersi* figures with the highest number of plant-families, recorded for the host-plants.

Gallery system and brood. The cutting out of tunnels, done in Bogor 1924, has provided an interesting series indicating the stages in the development and lay-out (Pl. 1, top). The pattern shows much the same general proportions as that of *C. fractus*, but it has slightly smaller dimensions, the bore of the galleries being 1.25 mm, the length of the pupal cells 4—5 mm. Only in one case a vertical branch was found, which, after the first 15 cm, curves into a horizontal plane and throws off secondary vertical branches along this bend.

From the number of brood collected (see table) it is evident, that the young beetles actually raised in one system rarely will surpass 25 specimens.

Host- timber	Gallery system				Brood collected					
	main galle- ry in cm	vertical branches			parent beetles	eggs	larvae	pupae	young adults	
		number	total length in cm	number of pupal cells					♀	♂
<i>Crossotarsus saundersi</i>										
<i>Thea</i>	3				2					
<i>Durio</i>	3				2	4				
<i>Canarium</i>	4				2		2			
<i>Dalbergia</i>	4				2	?	7			
"	6	2	12.0		2	?	9			
<i>Canarium</i>	8	8	7.6	4	2		9			
"	5	?	5.5	5	1		3	1		
"	5	5	11.0	11	1		8	6		
"	7	7	10.4	10	2		18			
"	6	5	14.7	11	2		16			
"	5.5	7	18.4	22	2		24	2		
"	4.5	8	20.3	20	2		14	4	1	1
<i>Thea</i>	7	5	10.4	11	2		3	4	7	3
<i>Crossotarsus squamulatus</i>										
<i>Thea</i>	5				2	6				
<i>Dalbergia</i>	7				2	11	1			
<i>Thea</i>	9	4	?		2	10	6			
<i>Canarium</i>	8.5	4	?	19	2		6	?	3	1
<i>Dalbergia</i>	9	4	26.9	21	2		6	3	8	6
<i>Crossotarsus fractus</i>										
<i>Dalbergia</i>	3.5				2					
"	5	2	1.3		2	21	6			
"	7.5	3	1.6		2	30	8			
"	4.5	3	2.5	2	2		7	2		
"	5.7	5	10.0	8			3	5		
"	5	3	27.0	16	2		8	8	1	2
"	7.5	4	20.5	19	2		2		6	7
"	3.7	2	37.0	33	2		7		6	5
"	8	10	25.0	26	2		4	7	10	5

1) predatory beetles present 2) most larvae in prepupal stage

Crossotarsi genuini Chap., 1865.

C. wallacei (Thomps., 1857), ♀ 10.5—11.0 mm, ♂ 9.0—9.5 mm. Sumatra: in trunk of *Durio carinatus*, Indragiri, VII.1924, submitted by the Forest Service; in trunk of damaged clove tree, *Eugenia aromatica*, at Manna in the Bengkulen District, X.1934 (leg. MAHYUDIN, see KALSHOVEN, 1936, p. 188).

In Malaya the robust beetle has been found associated with sickly rubber (*Hevea*) trees on numerous occasions (CORBETT & GATER, 1926, p. 261). BROWNE (1935, 1938) called the species a common shot-hole borer in the

forests of Malaya, where it had been encountered in timbers of various families.

C. javanus Bees., 1937, ♀ 9.0 mm, ♂ 8.0—8.5 mm (specimens sent to SAMPSON in 1923 have been misidentified as *C. wallacei*). J a v a : galleries with brood in trunk of dead "kikopi" (fam. Rubiaceae), on felling area at Tjiwidei, S. Priangan, 1000 m, XII.1918; the same in log of *Celtis wrightii* received at the Forest Research Institute, Bogor, 1919; boring right through sound bark at a height of 2—3 m in trunk of living, 10-year old *Hevea* tree, which had had one large branch torn off, part of the beetles drowned in the latex flow, at Kaliwringin Estate near Bodja, 400 m, XII.1922 (leg. NIEUWPOORT); a single ♂ boring in sickly *Hevea* tree, Buaran Estate near Krawang, II.1923 (leg. SPECHT GRIJP) (both latter cases mentioned in KALSHOVEN, 1924, p. 356 and 357 under *C. wallacei*); numerous in dying *Dalbergia latifolia* in plantation on Mount Pandan in the centre of the teak area of Bodjonegoro, V.1924; in log of *Pometia tomentosa* received from felling area on S. slope of Mount Gedé, at 1200 m, XII.1924. S u m a t r a : a single specimen in *Eucalyptus* sp., Kaban Djahé, 1925 (formerly in the collection of the Deli Experiment Station at Medan); and a male in a living trunk of *Albizzia sumatrana*, Pager Alam Estate, Benkulen, II.1937 (leg. TJOA TJEN MO).

It is noteworthy that in a series of female beetles, taken from the same trunk, part of the specimens — possibly juvenile individuals — have long fringes of golden hair all around the concave front of the head, while in the other part — presumably mature or old mother beetles — the hair tufts are completely absent. No intermediate stage was met with.

Galleries and brood. A good picture has been obtained of the tunneling of this species in the sapwood of *Dalbergia* trunks, which had a diameter of ca. 20 cm (Pl. 2, fig. 3). The main gallery is 7.5—11.5 cm long, often showing, after the first radial 6 cm, a distinct bend which may be sometimes rectangular of even acute. Up to 6 vertical galleries have been counted, terminating into at least 15 pupal cells. In still unbranched galleries 6—12 larvae were found and quantities of a granular matter of unexplained nature. A tunnel system with completed vertical branches contained 2 small and 30 medium and large larvae, besides the granular matter.

Crossotarsi nitiduli.

C. nitidulus (Schedl, 1954), ♀ and ♂ 3.4 mm. W. J a v a : one pair extracted from a borer-infested part of *Castanea argentea*, at Tapos, VIII.1933 (see SCHEDL, 1954). The species is only known by its type specimens.

Crossotarsi coleoprati.

C. squamulatus Chap., 1865, originally described in the ♀ sex only; the ♂ was described as *C. fragmentus* by SAMPSON in 1928, according to BEESON, 1937, who assigned the Java specimens, 4.65—5.45 mm in size, to a subspecies *C. squamulatus squamulatus*. J a v a : a single ♂ among many specimens of *Platypus jansonii* taken from damaged *Parkia speciosa*, Madjalengka, X.1913 (leg. DE WIJS); in logs of *Artocarpus elastica*, *Gluta reinghas* and *Millettia debiscens* received in Bogor from different parts of C. and E. Java, 1919;

numerous in dead *Theobroma cacao* trees, infested by many borers, IV.1921, and in dry branch of same host, VII.1924, Experiment Garden at Bogor; in dying transplanted young tree of *Canarium commune* with many other borers, Bogor, III.1924; in dead, multiple infested *Kopsia flavida* in the Botanical Gardens, Bogor, IV.1924; one gallery in branch cut from *Pithecolobium lobatum* at Dramaga, near Bogor, V.1924; numerous in *Dalbergia latifolia* killed by root fungus in plantation on Mount Pandan in the centre of the Bodjonegoro teak area, V.1924; several galleries in dead borer-infested trunk of unpruned tree of *Thea sinensis* in the Experimental Garden, Bogor, VI.1924 (referred to as *C. fragmentus* Samps. in MENZEL, 1929, p. 29); in dead trunk of "kayu matjem djengkol" — probably *Pithecolobium* sp. — at Tapos, 800 m, VI.1933 (mentioned by SCHEDL, 1941a); a single male found boring in *Aleurites moluccana*, Tjipetir Estate near Tjibadak, II.1938.

Gallery system and brood. The horizontal entrance tunnels are 6—9 cm in length. Up to 6 or 7 vertical branches are formed near their end (Pl. 2, fig. 2a and b). The details of a few selected galleries in various stages of development, and of the brood they contained have been entered in the table on p. 43.

C. fractus Samps., 1912, ♀ and ♂ 3.8—4.3 mm. J a v a : a single male taken at the lamp, Mount Wilis, 800 m, II.1925; numerous in *Dalbergia latifolia* trees killed by root fungus in plantation near Paree, Kediri, VI.1924, III-V.1925; in dead *Albizia procera*, same locality, IV.1925; a single ♀ in borer-infested *Quercus*, Mount Gedé, Tapos, 800 m, IX.1933. S u m a t r a : in *Eucalyptus* sp., Kaban Djahé, XII.1924 (submitted by the Deli Experiment Station).

Gallery system and brood. Out of some 20 tunnel systems exposed in 1924, in different stages of development some have been figured (Pl. 2, fig. 1) and their measurements and contents tabulated (p. 43).

C. terminatus Chap., 1865, ♀ (SCHEDL, 1936) 3.6—3.8 mm, ♂ 3.35—3.75 mm. W. J a v a : extracted in numbers from borer-infested parts of "durenan" (? *Aglaia argentea*), *Marumia muscosa* and *Castanea argentea*, and in few specimens from *Quercus* sp. and "pohon matjem djengkol" (*Pithecolobium*), Tapos, Mount Gedé, 800 m, II-X.1933.

BEESON (1941) has listed 3 hosts of the species in India and 5 hosts — including an *Aglaia* sp. — in Malaya.

DIAPINAE

Diapus Chap., 1865.

D. quinquespinatus Chap., 1865, ♀ and ♂ 2.7—3.0 mm, a wide-spread species, occurring in tropical Africa, Asia and Australia (SCHEDL, 1951). W. J a v a : attracted in numbers to newly felled *Eugenia argutata* in the Forest Reserve Takoka, Djampang area, XI.1918; a few specimens in timber of *Durio zibethinus*, Bogor, VI.1919 (native collector); boring in the trunk of *Quercus fagifolia* which had the bark peeled off, Gunung Beser, N. Djampang, IX.1920; found starting to bore into the freshly-cut surface of a *Pygeum parviflorum* felled 2 hours 30 minutes previously and similarly into the fresh axe wounds in trunk of *Gluta* or *Semecarpus* ("reungas") and *Sloanea sigun*, the first two species being more attractive than the latter in which only a single specimen was

observed, in felling area at Tjidahu, S. slope of Mount Salak, 800 m, V.1922; one of the species in a mixed sample of ambrosia beetles found in *Albizzia* timber (leg. Ch. BERNARD), I.1923; numerous specimens found swarming on the inner side of windows in a cottage at Tapos, Mount Gedé, 800 m, VI.1932; a single specimen in borer-infested dead *Horsfieldia* ? *glabra* in lowland forest near Bandjar, VII.1932; the same in *Castanea argentea*, Tapos, II.1933.

D. aculeatus Bldf., 1894, originally described from Japan, ♀ 2.5—2.7 mm, ♂ 2.3—2.5 mm. W. Java: collected in small numbers from logs of *Castanea javanica* and *C. tunggurut*, received in Bogor from felling area on S. slope of Mount Gedé, 900 m, XI. 1924.

Gallery system. A single tunnel which was exposed on a cross section through a *Castanea* log, is broadly ramified, after the first 3 cm of the entrance part, and has a total length of 45.5 cm. The terminal portions of small side branches with the comb-like arrangement of the pupal cells, are situated at a depth of 6—7 cm from the wood surface; one two-sided comb has 14 craddles.

D. pusillimus Chap., 1865, ♀ 2.5—2.7 mm, ♂ 2.1—2.5 mm, a wide-spread species known from C. Africa, the Indomalayan region, Australia and Samoa (SCHEDL, 1951). W. Java: attracted in a fair number to newly felled *Eugenia argutata* in company with *D. quinquespinatus*, Forest Reserve Takoka, Djampang area, XI.1918; from the same host and locality, 1921 (leg. W. C. VAN HEURN); in log of *Altingia excelsa* in timber yard at Bandung, VIII.1940 (leg. P. A. BLIJRDORP).

D. minor Schedl, 1954, ♂ 1.89—1.9 mm. W. Java: a few specimens in borer-infested trunk of old *Cinnamomum camphora* felled in the Tjibodas Gardens, Mount Gedé, 1500 m, VIII.1923; a few specimens in log of *Castanea javanica*, received in Bogor from felling area on S. slope of Mount Gedé, 900 m, XI.1924.

REVIEW OF PLATYPODID ATTACKS ON LIVING TREES

Several instances have been mentioned in the preceding pages recording attempts made by Platypodid beetles to bore into living parts of plants, but all leading to the death of the beetles, an intriguing fact.

An early account dealing with the fruitless attack of the beetles on very freshly felled timber was found in WALLACE's "Malay Archipelago", and is quoted here in full to show how futile attacks like these have intrigued the biologists of old. The observation was made in Dobbo, Aru Islands, in 1857.

"Some sailors cut down a good-sized tree, and, as is always my practice, I visited it daily for some time in search of insects. Among other beetles came swarms of the little cylindrical wood-borers (*Platypus*, *Tesserocerus*, & c.), and commenced making holes in the bark. After a day or two I was surprised to find hundreds of them sticking in the holes they had bored, and on examination discovered that the milky sap of the tree was of the nature of gutta-percha, hardening rapidly on exposure to the air, and glueing the little animals in self-dug graves. The habit of boring holes in trees in which to deposit their eggs, was not accompanied by a sufficient instinctive knowledge of which trees were suitable, and which destructive to them. If, as is very probable, these trees have

an attractive odour to certain species of borers, it might very likely lead to their becoming extinct; while other species, to whom the same odour was disagreeable, and who therefore avoided the dangerous trees, would survive, and would be credited by us with an instinct, whereas they would really be guided by a simple sensation."

In recent times BROWNE (1949) dealt in some details with an infestation of young, healthy trees of *Shorea leprosula* by two species of *Diacavus* in Malaya. The apparent reason was that some heavily infested logs of the same timber were lying in the immediate vicinity and that the beetles swarming from them had found no better breeding medium than the young trees, the *Diacavus* species being particularly associated with Dipterocarpaceae.

BROWNE referred in his paper to the occurrence of old, overgrown pin-holes found in an apparently healthy ash tree and due to a former attack of *Platypus cylindrus*, observed in England by FISCHER (1937). In this instance the examination of the annual rings of the trunks showed that the tree had suffered from a sudden check in its development for some unknown reason, this stagnation probably having induced the beetles to the attack.

Yet another case cited by BROWNE concerns an attack on living *Eucalyptus* trees by *Crossotarsus saundersi* in South Africa in 1947. "This infestation appeared to be correlated with the occurrence of a severe drought, and it is stated that when rainfall occurred the attack stopped."

Passing on now to a discussion of the attacks on living trees observed in Java — the available records being given more completely than in the preceding pages — I made a division into groups of cases, in which the conditions appear to be different.

(a¹). Attacks have been seen in trees which were apparently suffering from adverse conditions of a physical or organic nature but which still had sufficient vigour left to produce quantities of sap (gum, resin, etc.) from the bore holes. This has been observed in an *Aleurites* tree (see *Platypus jansoni*) in a plantation and a *Symplocos* tree in the forest (see *P. signatus*). In the first case all borers were drowned by the gum oozing from the holes, in the second case part of the borers were killed, but several had succeeded in establishing themselves.

(a²). Platypodids have also been found boring into the sound bark of trees which had been damaged in other places. So the beetles have been observed boring right through the sound bark into the wood of a rubber tree (*Hevea*), which had been damaged — but not killed — by lightning, and in the base of *Schima* trees, which were infested by a primary longicorn borer (see *P. vethi* and *P. edentatus*), but which did not show any signs of less vitality in their crowns, and finally, all over the trunks of *Melia azedarach* (Pl. 3) and *Adenanthera microsperma*, which had the base damaged by a mud-stream (see under a³). In all these instances the borers had been killed in their attempts to enter the sound parts, and were drowned or driven out by the latex flow (in *Hevea*) or the abundant exudation of gum.

(a³). Some time after a rock and sand carrying mud-stream ("lahar"), caused by the eruption of Mount Klut, had forced its way through the forest area

Gadungan, near Paree, Kediri, numerous trees in adjacent parts of 3—4 year old plantations which had not directly suffered, were attacked by *Platypus* beetles. In some of the tree species the attacks were particularly conspicuous. From the pin-holes made in the trunks of *Melia* large clumps of gum were produced, which afterwards hardened and became brittle; *Dalbergia* trees produced drops of a thick blood-red sap ("kino") from the punctures, which sap turned into a black substance after drying (Pl. 3); *Cassia siamea* trunks showed exudations of dirty black sap, staining the bark round the holes. Dead beetles, belonging to *P. solidus* and *P. pseudocupulatus sundaensis* were found enclosed in the exudations or sticking to the dry substance.

In all these instances (a1-3) it was clear that the beetles had been attracted by damaged and dying trees but had not been entirely successful in locating the exact places where they could enter unhampered. The last example reminds one of the behaviour of *Xyleborus fornicatus* in attacking trees other than its regular hosts, as recorded in a former paper (KALSHOVEN, 1958a).

(b). It not seldom occurs that the beetles alight on and try to bore into the trunk of trees which have a perfectly healthy appearance, but are standing on exposed places like road sides, borders of plantations, and mountain ridges. Three such cases have become known for *Acacia decurrens*, the tanning bark yielding tree introduced from Australia. It was first observed in a tree standing in the Tjinjiruan Quinquina Plantation in E. Priangan at some 1500 m above sea level, where the attack caused by a *Crossotarsus* (since recognized as *C. squamulatus*) was conspicuous for the abundant flow of gum from the pin-holes (WIND, 1924). Another case, investigated by myself (KALSHOVEN, 1925) concerned absolutely healthy, 2 year old specimens of *A. decurrens* standing along the border of a mixed forest plantation of the same age in the Djampang area at an altitude of 1000 m, which trees were being attacked by *Platypus solidus*. This, again, had resulted in a plentiful production of gum from the pin-holes, drowning the beetles. Finally, similarly attacked specimens of *A. decurrens* were seen by me at Artjamanik, N.E. of Bandung, at ca 1200 m, where single trees were growing near the resthouse and were lining 5 year old plantations. Here *P. horni* was the culprit (VI.1927).

Platypus solidus has also been observed attacking "ingas" trees (*Gluta* or *Semecarpus* sp.) standing on a native cemetery in the open field in Banyumas and marked by black stains of dry sap in consequence (observation by VERBEEK, V.1927), and the same beetles have often been found attacking trees of *Dalbergia latifolia* standing along road sides or forming the borderline in plantations. In the preceding notes similar attacks on the latter trees have been mentioned for 3 other species, *P. velhi*, *P. cavus* and *P. pseudocupulatus*. Since the resulting external marks on these trees are very conspicuous, as explained above, the passing attacks have been reported several times by forest officers, who referred to the symptoms as the "bleeding" of the trees. The punctures which scarcely enter the sapwood have, however, no or little effect for the quality of the timber.

Yet another instance of a similar occurrence of the borers, and mentioned in the preceding pages, deals with healthy *Schima noronhai* trees, standing on a mountain ridge, where numerous specimens of *P. cavus* accompanied by *P. solidus*

had found their death in trying to bore into the trunks. The bark was already closing up on a part of the punctures, but the remnants of the beetles were still attached to them; other holes had been freshly made. No exudation of sap or gum had followed here and the traces were found purely by accident. It may be well, that such attacks occur more often on trees where they do not result in the extrusion of coloured sap, gum or latex, and therefore remain unobserved.

Trying to find an explanation for these "abnormal" cases in the habits of the Platypodids BROWNE's opinion may be repeated here that the beetles swarming in numbers from infested logs and trunks, and failing to find suitable breeding places in the immediate neighbourhood, are led to alight on healthy trees. However, as in this case the beetles belong to a group of unselective *Platypus* species, not associated with certain hosts, the beetles apparently try to settle in indifferent trees. It is further suggested that in this instance the beetles are directed more by sight than by scent.

(c). Apparently still more puzzling is the fruitless attack of the beetles of *P. cupulatus* and *P. pseudocupulatus sundaensis* on the spear of *Agave* plants, as has been reported from Deli, Sumatra. The beetles had pierced a few of the closely folded leaves and then had succumbed. Any further details are missing, but we may assume that the plants were growing on a new clearing where many remnants of felled trees and burned logs — suitable breeding places for the Platypodids — were present. The round cone in the centre of the *Agave* plants must have been "mistaken" for a trunk.

Reviewing the various observations and explanations the following general conclusions can be made:

Platypodidae find optimal conditions in dying and newly dead trunks, which have not yet lost any moisture, and the beetles are able to detect trees in an incipient stage of weakness or other slight deficiency. They may be successful in penetrating the wood and extending their tunnels in all cases where the condition of the host entails a loss or a reduction of the ability to regenerate and to react on wounds and other damage. The issue of liquid matter like gum, gutta, kino, latex and resin from the pierced bark tissue or the outer sapwood layer is the main or only hindrance for them to establish themselves in the trunks. Possibly they might be able to breed in the inner wood layers of completely healthy trees if they were not impeded by the sap-flow of the outer tissues and if their entrance holes were not closed by callus growth.

Being attracted to trees which are temporarily affected by unfavourable conditions and damages, the Platypodids are not able to distinguish between trees which are still vigorous and those which have lost their defensive properties. Failing to find suitable breeding places they are even led to bore into healthy trees. This apparently may lead to considerable losses in numbers, a disadvantage which does not imperil their survival ability and is outweighed by the opportunity to be early on the scene where a breeding medium is nascent.

In virgin forests there will always be sufficient breeding places for the beetles in trunks and branches of trees which are dying from old age or have

been primarily attacked by fungi or insects, or which have suffered from drought, fire, floods, gales, lightning, sudden exposure and sunburn, vulcanic eruptions and similar calamities.

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